

# Alternative and Renewable Fuel and Vehicle Technology Program

## FINAL PROJECT REPORT

# Assessing the Multi-Unit Dwelling Barrier to Plug-in Electric Vehicle Adoption in the South Bay

# DRAFT

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Prepared by: South Bay Cities Council of Governments and the  
UCLA Luskin Center for Innovation



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## PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVT Program). The statute, subsequently amended by AB 109 (Núñez) Chapter 313, Statutes of 2008), authorizes the California Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. The Energy Commission has an annual program budget of about \$100 million and provides financial support for projects that:

- Develop and improve alternative and renewable low-carbon fuels.
- Enhance alternative and renewable fuels for existing and developing engine technologies.
- Produce alternative and renewable low-carbon fuels in California.
- Decrease, on a full-fuel-cycle basis, the overall impact and carbon footprint of alternative and renewable fuels and increase sustainability.
- Expand fuel infrastructure, fueling stations, and equipment.
- Improve light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets.
- Expand infrastructure connected with existing fleets, public transit, and transportation corridors.
- Establish workforce training programs, conduct public education and promotion, and create technology centers.

The Energy Commission issued solicitation PON-14-603 to provide funding opportunities under the ARFVT Program for Zero Emission Vehicle (ZEV) Readiness. This first-come, first-served grant solicitation was an offer to fund projects that support new and existing planning efforts for plug-in electric vehicles (PEV's) and fuel cell electric vehicles (FCEV's). To be eligible for funding under PON-14-603, the projects needed to be consistent with the Energy Commission's *ARFVT Investment Plan*, updated annually. In response to PON-14-603, the recipient submitted application 4, which was proposed for funding in the Energy Commission's Notice of Proposed Awards January 16, 2015, and the agreement was executed as ARV-14-035 on March 19, 2015.

## ABSTRACT

Governor Jerry Brown established an executive order calling for 1.5 million zero emission vehicles (ZEV) on California's roads by 2025. To achieve this ambitious goal, significant barriers must be overcome to expand and accelerate plug-in electric vehicle (PEV) adoption including the need to build out the necessary refueling infrastructure. To the point, residents of multi-unit dwellings (MUDs) are unlikely to have access to home charging (electric vehicle supply equipment or EVSE) due to the variable and often high cost of installation, as well as the low to non-existent investment motivation of the MUD renter or owner.

The purpose of the following report is to explore the MUD barrier to PEV adoption within the South Bay subregion in Los Angeles County and identify MUDs within the study area that may exhibit high latent PEV demand and low-cost EVSE installation for the purpose of targeted outreach. Researchers analyzed Los Angeles County Office of the Assessor tax parcel data to understand the MUD portfolio of the South Bay, as well as IHS-Polk Automotive new car registration data to identify census tracts in the South Bay that have exhibited high PEV demand to date. Researchers also visited 27 MUD sites within the South Bay and reviewed 19 EVSE installation cost estimates to evaluate how installation costs can vary across MUD sites.

The results confirm that the cost of EVSE installation in MUDs is variable from site to site and often high. Level 1 charging and group investments for EVSE installations may provide MUD residents access to home charging at lower costs. Policy tools such as targeted outreach to promote the PEV, as well as rebates or PEV-ready new construction codes are likely to be required to ease the MUD barrier to PEV adoption.

**Keywords:** Plug-in electric vehicle, PEV, multi-unit dwelling, MUD, PEV charging, EVSE, South Bay, California Energy Commission, demand, installation costs

## EXECUTIVE SUMMARY

In 2012, Governor Jerry Brown signed an executive order creating a goal of 1.5 million zero-emission vehicles (ZEVs) on California's roadways by 2025. To achieve this ambitious goal, a number of adoption barriers must be overcome. In the Governor's 2013 ZEV Action Plan, the first challenge addressed is the need to build out the necessary refueling infrastructure. ZEVs, and specifically PEVs, require an entirely new refuel behavior and set of equipment. In place of a 15-minute detour to a gas station, most PEV owners refuel when they are at home overnight using Level 1 or Level 2 charging (electric vehicle service equipment or "EVSE"). While this is generally a straightforward proposition for single-family homeowners, multi-unit dwelling (MUD) residents as well as owners face a number of obstacles to installing EVSE at home. Foremost is the variable and often high cost of EVSE installation. Additionally, the renter or owner exhibits a low to non-existent investment motivation: renters are unlikely to invest in a piece of immobile equipment that they may move from in the future; and owners do not yet see home PEV charging as an amenity by which to increase property value and attract tenants.

The following report seeks to explore the MUD as a barrier to greater PEV adoption in the context of the South Bay subregion, as well as to prioritize and target outreach and other policy tools for MUDs that exhibit high latent PEV demand and a low cost of EVSE installation. The South Bay's demographics and regional characteristics makes this report applicable across other regions of the State. The report represents Part 2 of 3 of the Agreement Number ARV-14-305; Part 3 of the Agreement, the "Owner's Toolkit" and report of the presentation of findings to MUD owners, are found in the appendix to this report; additionally, the appendix contains a report entitled, "South Bay MUD EVSE Proximity Siting Review" – a preliminary study to examine a complementary infrastructure development strategy that would site EVSE near clusters of high density MUDs.

The UCLA Luskin Center for Innovation analyzed land use data from the Los Angeles County Office of the Assessor and new car registration data from IHS Automotive to understand the MUD portfolio of the South Bay subregion and identify MUD parcels that are likely to exhibit latent PEV demand. Additionally, researchers visited 27 MUD sites across the South Bay with a qualified electrician and reviewed 19 EVSE installation cost estimates to evaluate the cost of providing home charging to MUD residents and identify potential low-cost home charging solutions. The UCLA Luskin Center for Innovation finds that while the cost of EVSE installation at MUD sites is indeed variable and often high, low-cost solutions may exist and policy tools can be designed to take advantage of these solutions. The key results of our findings include:

**The South Bay is a leader in PEV adoption despite a significant number of MUD households:** The South Bay subregion is home to 5,657 PEV drivers and 144,132 MUD households including 33,785 MUD households in disadvantaged communities. The MUD barrier is likely serving as a significant constraint to PEV adoption in the subregion. Programs and policies aimed at expanding PEV adoption and home charging access to MUD residents are likely to find the South Bay to be a quality candidate for implementation.

**EVSE installation costs are variable and often high:** Level 2 EVSE installation costs ranged between \$1,800 and \$17,800 and averaged \$5,400. To contrast, single-family EVSE installations average \$1,500.

**The cost of EVSE installation is positively correlated to the distance between the relevant electric panel and PEV parking spot:** Of the 6 projects evaluated required a conduit run of 100 feet or greater, construction or engineering activities such as coring, trenching, and/or the x-raying of concrete, greatly increasing the cost of installation.

**Detached parking layouts are likely to incur high EVSE installation costs:** With the parking area separated from the main MUD structure, there is a high probability of needing to trench or perform some other construction activity to run wiring and conduit from the panel to the PEV parking spot.

**Level 1 charging may be a feasible home charging solution for MUD residents:** Most MUD parking in the South Bay (78%) was found to have access to a 110/120-volt outlet. To perform Level 1 charging, the property owner and/or electrician would need to assess the electrical capacity of the relevant panel.

**Group investments of EVSE installation greatly reduce the per driver cost of installation:** The high variable costs of EVSE installation and the group parking environments of some MUD parking layouts provide an opportunity for group investments to reduce per driver costs.

Governments, state agencies, and other relevant stakeholders can use these findings and others to design policies and programs moving forward. Interested stakeholders can also use the following report to gain a better understanding of the MUD barrier to PEV adoption and how it is likely constraining the South Bay subregion's full PEV adoption potential.

**Proximity siting of EVSE to clusters of MUD properties may prove a complementary EV infrastructure strategy:** Where MUD inventory is too old, too costly or exempt from owner compliance to upgrades, a strategy of building or encouraging EVSE development in proximity to clusters of MUD properties may prove successful to the continued development of the EV market.